CONTINUITY OF INTERIOR DEPOSITS IN WESTERN CANDOR CHASMA, VALLES MARINERIS, MARS: WIPED OUT BY FAULTING OR EROSION?

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Summary: We present our first results from study of the interior deposits of western Candor Chasma. Using high-resolution DEMs, we mapped four major units to separate intact wall rock, landslide materials, other floor materials, and the interior deposits. We then evaluated a possible northwest-trending fault to determine if the continuity of the interior deposits is disrupted primarily by faulting or, most likely, by erosional processes. We plan to identify the stratigraphy and response to deformation (including faults and folds) in order to (a) establish plausible material properties and (b) reconstruct the emplacement and subsequent history of the interior deposits in western Candor Chasma.

Introduction and Background: Western Candor Chasma is a northwest-southeast trending trough in the Valles Marineris system. Within the chasma, there is a series of deposits that appear to be friable, of medium to high porosity, and form both massive and stratified sequences.

Why look at the interior deposits of Western Candor Chasma? The origin of these materials is still enigmatic. There are several possibilities: fluvial, subaerial, subaqueous, and volcanic [1-4]. One goal of this study is to revisit methods for the formation and subsequent removal of materials within the troughs.

The soft, poorly indurated sedimentary rocks of which the interior deposits are composed [5] are now recognized as a class of materials that are globally important for Mars. Therefore, the Valles Marineris interior deposits may be similar in their origin, deformation, and hydrologic properties to other materials outside the troughs, such as the polar and intracrater fill deposits.

In this abstract, we test whether the isolation of the interior deposits in western Candor Chasma into large mounds is primarily controlled by structure or by erosion.

Methods, Results and Implications: We created a DEM of western Candor Chasma with a resolution of 200 pixels per degree (295 m per pixel). We then mapped four distinct units: (1) intact wall rock, (2) landslide scar and material, (3) other, non-landslide floor material, and (4) interior deposits. Units were determined based upon preliminary mapping done by Lucchitta and Schultz [6]. From the Candor DEM, we can infer the presence of a northwest-trending linear depression through the chasma (Fig. 1). This linear feature within the chasma shows a significant elevation low, suggesting either faulting or erosion. The presence of other northwest-trending features within Candor Chasma as well as the rest of Valles Marineris suggests that, regardless of the primary nature of this particular depression, it is controlled at least partially by structure.

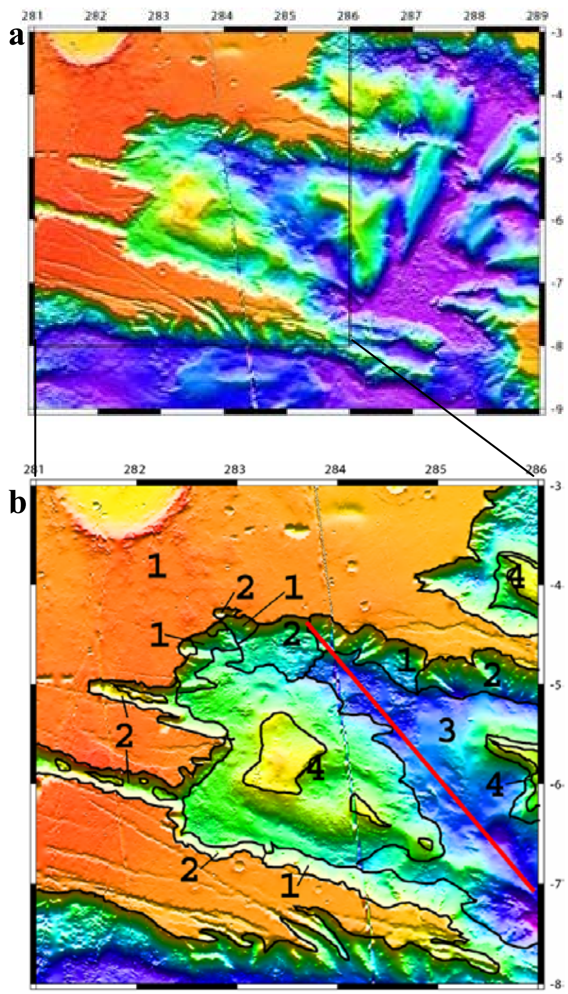

Figure 1a. Western Candor Chasma. 1b. Units are as follows: (1) Intact Wall Rock; (2) Landslide Scar and Material; (3) Other Floor Material; (4) Interior Deposits. Fault indicated in red.

Using the unit geometry as well as the topographic low as a guide, we evaluate the role of a 209-km fault on continuity of the interior deposits in western Candor Chasma. We see no evidence at the intersection of the fault and wall rock to suggest that the fault penetrates the wall; therefore, we assume that the fault stops at this point (see Fig. 1b).

Length	γ	*Displacement*
209 km	10^{-2}	D_{MIN} = 2.09 km
209 km	10^{-1}	D_{MAX} = 20.9 km

Table 1. Displacement-Length relation for the suspected 209-km fault.

Both the calculations of displacement versus length as well as the fault geometry necessary to create the observed arrangement of the interior deposits suggest that the northeast boundary of Western Candor Chasma is not primarily fault-controlled. The interior deposits are eight to ten km high. For fault control to be a plausible mechanism, the displacement along the fault would have to be in the upper end of the range calculated; also, the geometry would have to be such that a second fault exists in the same location as the first, but with an opposite dip angle, so that the western margin of the interior deposits located to the east of the depression would also be faulted, but with the opposing dip direction. It is possible that a combination of faulting and erosion led to the present configuration of the interior deposits; pre-depositional faulting may have created a weak zone where erosion occurred at a higher rate, leading to the observed topographic low.

Future work includes evaluating, in more detail, where and how the missing material was transported. The question remains, where did the rest of the interior deposits go, or were they never present in the first place? Using volumetric calculations for the missing deposits and the troughs, we will determine where the materials went and the mechanism by which they traveled. We will also map out and correlate the bedding attitudes of the mounds both west and east of the linear depression within Candor Chasma. This will help test the plausibility for faulting and deformation during emplacement of the interior deposits. We expect one of three conditions to be confirmed: (1) horizontal bedding and continuity, indicating a primarily erosional history, (2) one mound deformed and the other intact, indicating unique structural processes for each mound, or (3) both mounds deformed, consistent with a common, single fault between the two masses where one mound sits on the foot wall and the other sits on the head wall.

Our ultimate goal is to determine a viable explanation for the creation, response, deformation, and history of the Western Candor interior deposits. The results will be useful to determine the hydrology of the area, as well as the origin and the timing of the interior deposits. We are evaluating all possibilities as part of the first phase of this project.

References: [1] Chapman M. G. and Tanaka K. L. (2001) *JGR, 106,* 10,087 – 10,100. [2] Lucchitta B. K. (1990) *Icarus, 86,* 476 – 509. [3] Nedell S. S. et al. (1987) *Icarus, 70,* 409 – 441. [4] Lucchitta B.K. et al. (1994) *JGR, 99,* 3783 – 3798. [5] Malin M. C. and Edgett K. S. (2000) *Science, 290,* 1927 – 1937. [6] Lucchitta B. K. and Schultz R. A. (in compilation, 2003) *Geologic Map of Ophir and Central Candor Chasmata (MTM -05072) of Mars.*